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METHODS FOR DETECTION AND ESTIMATION OF DAMAGE IN JUTE FABRICS DUE TO MICRO-ORGANISMS

(*First Revision*)

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Indian Standard

METHODS FOR DETECTION AND ESTIMATION OF DAMAGE IN JUTE FABRICS DUE TO MICRO-ORGANISMS

(First Revision)

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Indian Standard

METHODS FOR DETECTION AND ESTIMATION OF DAMAGE IN JUTE FABRICS DUE TO MICRO-ORGANISMS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 23 March 1984, after the draft finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textile Division Council.

0.2 This standard was first published in 1962. It has now been revised with a view to making it up-to-date on the basis of the experience gained during its use. Changes have been made in the conditioning, sampling and testing clauses so as to bring the standard in line with other similar standards. Preliminary tests involving smelling at the specimens have been deleted because the inhailing of bacteria is very unhygenic and harmful, especially when this is repeatedly done.

0.3 Jute fabrics are liable to be attacked and damaged by micro-organisms, such as bacteria and fungi, while in transit, storage or use. The deterioration is promoted by climatic conditions prevalent in tropical and subtropical countries.

0.4 Moisture is essential for the development and growth of micro-organisms, the amount of moisture required being dependent upon the type of organism. Thus fungi usually develop when the relative humidity of the environment approaches about 75 percent, and the growth is rapid when the relative humidity is above 85 percent. Bacteria, on the other hand, are active only when the substrate on which they are present is itself wet.

0.5 Fungi may appear as a fine downy growth or as dark spots or stains causing discoloration of the fabric. The isolated regions of mould growth may show considerable tendering while the rest of the material may indicate little are no tendering. If the fabric had been in contact with soil or had been contaminated with it and then exposed to dampness, the entire material may show rapid and uniform tendering.

0.6 The degree of growth of micro-organisms as well as their tendering effect may differ widely even in the immediate neighbouring areas in the fabric. It is, therefore, not practicable to submit the results of the tests prescribed in this standard to statistical analysis.

0.7 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard prescribes methods for detection and estimation of damage in jute fabrics due to micro-organisms.

2. ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTING

2.1 The specimens for breaking load testing shall be conditioned and tested in the standard atmosphere at 65 ± 2 percent relative humidity and 27 ± 2°C temperature (*see* IS : 6359-1971†).

2.2 When the specimens have been left in such an atmosphere for 24 hours in such a way as to expose, as far as possible, all portions of the specimens to the atmosphere, they shall be deemed to have reached moisture equilibrium.

3. SAMPLING

3.1 Lot — The quantity of similar jute fabric, delivered to a buyer against one despatch note shall constitute a lot.

3.2 Samples for test shall be drawn so as to be representative of the lot. Samples drawn in accordance with the material specification or as agreed to between the buyer and the seller shall be taken as representative of the lot.

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*Rules for rounding off numerical values (*revised*).

†Method for conditioning of textiles.

3.3 The samples shall be first visually examined for the presence of mould growth, indicated by isolated dark portions, stains, discoloration, etc all the portions showing mould growth shall be clearly marked.

3.4 From the marked portions of the samples, draw at random 10 pieces, each 2·5 × 2·5 cm in size. These shall constitute the test specimens for the purpose of **5.3** and **5.4**.

3.5 From the marked portions of the samples, draw at random 11 pieces, each measuring 33 × 12·5 cm in size. Unravel yarns from both sides of each specimen so that the width of the specimens is 10 cm. These shall constitute the test specimens for the purpose of **6.1** and **6.2** (*see* Note under **3.6**).

3.6 From the unmarked and undamaged portions of the samples, draw at random 11 pieces, each 33 × 12·5 cm in size. Unravel yarn from both sides of each specimen so that the width of the specimens is 10 cm. These shall constitute the control specimens for the purpose of **6.1** and **6.2**.

Note — The test and control specimens should be drawn so that the length of all the specimens is in the direction of either warp or weft, preferably in the direction of warp.

4. QUALITY OF REAGENTS

4.1 Unless specified otherwise, pure chemicals and distilled water (*see* IS : 1070-1977*) shall be used in tests.

Note — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the test results.

5. DETECTION OF DAMAGE

5.1 Apparatus

5.1.1 *Glass Slides* — 15 pairs.

5.1.2 *Microscope* — with a magnification range of 50 to 900.

5.2 Reagents

5.2.1 *Lactophenol Solution* — Dissolve 100 g of phenol in 100 ml of water and add to the solution 100 ml each of glycerine and lactic acid.

5.2.2 *Chlorazol Sky Blue (New Colour Index No. 24410) Solutlon* — 2·5 percent solution in distilled water.

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*Specification for water for general laboratory use (*second revision*).

5.2.3 *Acid Erythrosin (New Colour Index No. 45430) Solution* — 1·0 percent solution in distilled water. Dilute 1 part of this solution with 3 parts of distilled water.

5.3 Detection of Fungal Damage

5.3.1 Take 5 test specimens drawn as in **3.4** and unravel yarns from each. Take 5 or 6 yarns from each specimen and tease them gently on a glass slide to separate individual fibres. Treat the fibres with a few drops of Chlorazol Sky Blue solution for 1 to 2 minutes.

5.3.2 Put about 50 ml of distilled water in a 125-ml conical flask and boil it briskly. Steam the fibres for 30 seconds by placing the slide on the mouth of the flask.

5.3.3 At the end of 30 seconds, remove the slide and blot off the excess Chlorazol Sky Blue solution with blotting paper.

5.3.4 Treat the fibres on the slide with a few drops of lactophenol solution. Following the procedure prescribed in **5.3.2** steam the fibres for 30 seconds. Remove the slide and blot off the excess lactophenol solution.

5.3.5 Mount the fibres on a separate slide with a few drops of lactophenol solution. If necessary, separate the fibres by teasing them apart gently. Cover them with a cover slip and examine a small portion of the aggregate under the microscope with a magnification of 50 to 500. Examine 5 slides in all.

5.3.6 If the slides show blue stained hyphae, report the lot to have been damaged by fungal attack.

5.4 Detection of Bacterial Damage

5.4.1 Take the remaining 5 test specimens drawn as in **3.4** and unravel yarns from each. Take 5 or 6 yarns from each specimen and tease them gently on a glass slide to separate individual fibres. Treat the fibres with a few drops of Acid Erythrosin solution for 1 to 2 minutes.

5.4.2 Following the procedure described in **5.3.2** steam the fibres for 30 seconds. Remove the slide and blot off the excess Acid Erythrosin solution with blotting paper. Wash the fibres on the slide several times with distilled water by adding a few drops of distilled water and blotting them off.

5.4.3 Mount the fibres on a separate slide with a few drops of distilled water. If necessary, separate the fibres by teasing them apart gently. Cover them with a cover slip and examine a small portion of the aggregate under the microscope with a magnification of 500 to 900. Examine 5 slides in all.

Note — Both damaged and undamaged fibres will be stained red, but the presence of bacteria will be indicated by a comparatively deeper red stain. For reference, undamaged fibres should also be tested.

5.4.4 If the slides show deep red stains, report the presence of bacteria in the fabric under examination.

6. ESTIMATION OF DAMAGE

6.0 Estimate the damage in the sample under test by the methods given in **6.1** and **6.2**

Note — If the damage is not very great or if only a small quantity of samples is available for testing, only the method prescribed in **6.2** may be used.

6.1 Breaking Load Test

6.1.1 Take 10 test specimens out of the eleven drawn as in **3.5** and condition them to moisture equilibrium in the standard atmosphere. Determine the breaking load of each specimen on a horizontal or vertical type strength testing machine, keeping the distance between the grips of the machine as 20 cm and at a rate of traverse of 45 cm/min. Find the average of all the values.

Note — The breaking load of the individual test specimens may vary widely among themselves depending on the degree of tendering of each specimen.

6.1.2 Determine as prescribed in **6.1.1** the average breaking load of 10 control specimens out of the eleven drawn as in **3.6**.

6.1.3 Calculate the loss in breaking load, percent, of the fabric after being damaged (L) by the following formula:

$$L = \frac{100(a - b)}{a}$$

where

a = average breaking load of the control specimens, and

b = average breaking load of the test specimens.

Note — If the value of L is more than 20 percent the fabric should be declared as damaged. The degree of damage will increase with the increasing value of L.

6.2 Damage Count Test

6.2.1 *Reagents*

6.2.1.1 *Caustic soda solution* — 10 percent, (m/v), in distilled water.

6.2.1.2 *Herzberg's reagent* — Dissolve 2 g of zinc chloride in 10 ml of water. Dissolve separately 2·1 g of potassium iodide and 0·1 g of iodine in 5 ml of water. Mix the two solutions thoroughly.

6.2.2 *Procedure*

6.2.2.1 Take the remaining 1 test specimen drawn as in **3.5** and unravel yarns from it. Take 5 or 6 yarns, cut them into small lengths and tease them into individual fibres. Mix the fibres thoroughly and cut them into pieces of about 1 cm length. Immerse the cut fibres in 10 percent caustic soda solution for 3 minutes to wet them thoroughly. At the end of this period, remove the fibres from the alkali solution. Wash the fibres thoroughly with several changes of water and squeeze out the excess water by pressing them between pieces of filter paper. Dry the fibres in an air-oven at a temperature not exceeding 100°C for a period not exceeding 10 minutes. Roll the dried fibres into a narrow wick and shred into small bits of about 0·5 to 1 mm length.

6.2.2.2 Take a glass slide and place on it a drop of Herzberg's reagent. With the help of a pair of dissecting needles put a portion of the fibres in the Herzberg's reagent. Carefully separate the individual fibres in the reagent with the help of the needles.

6.2.2.3 Boil briskly about 100 ml of distilled water in a conical flask of 250 ml capacity until a continuous stream of steam is produced. Then place the slide on the mouth of the flask and steam the fibres on it for exactly 1½ minutes. At the end of this period, remove the slide.

6.2.2.4 Cover the fibres with a cover slip and examine the slide under the microscope with a magnification of 80.

NOTE — Damaged fibres appear more or less straight whereas undamaged fibres show a characteristic spiral formation (*see* Fig. 1 *and* 2). The photomicrographs in Fig. 1 and 2 are taken with a magnification of 200, though a magnification of 80 is sufficient for the purpose of this test.

6.2.2.5 Count separately the number of damaged and undamaged fibres and calculate the damage count of the fibres on the slide by the following formula:

$$\text{Damage count} = \frac{a}{a+b} \times 100$$

where

a = the number of damaged fibres, and

b = the number of undamaged fibres.

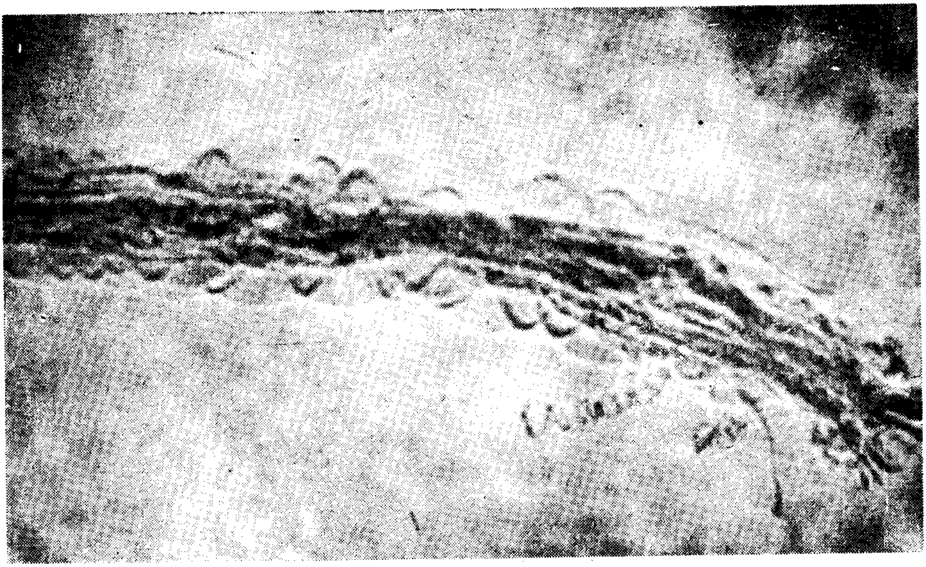

FIG. 1 UNDAMAGED JUTE FIBRE

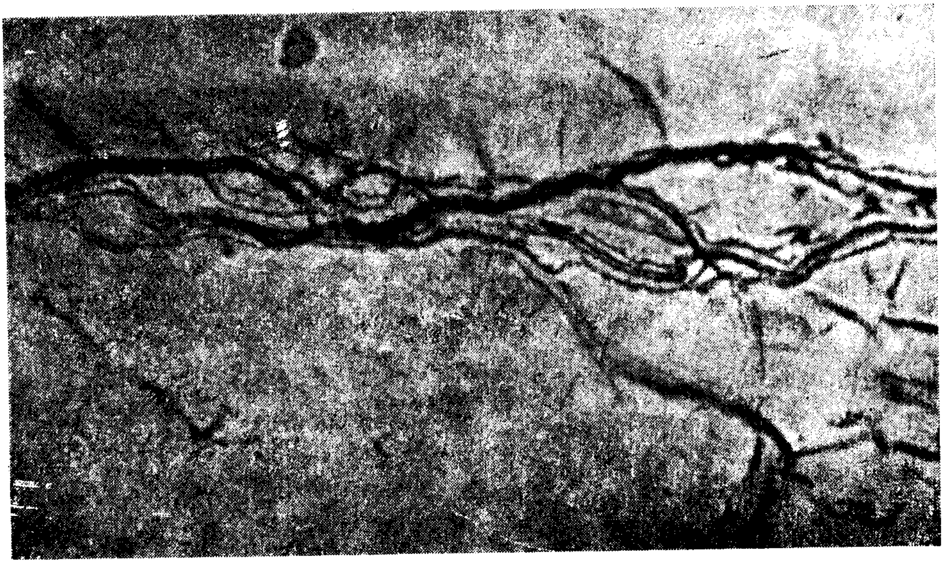

FIG. 2 DAMAGED JUTE FIBRE

6.2.2.6 Examine 5 to 10 slides (covering about 500 fibres in all) and calculate the average of all the values obtained.

6.2.2.7 Following the procedure prescribed in **6.2.2.1** to **6.2.2.6** determine the average damage count of the fibres in the remaining 1 control specimen drawn as in **3.6.**

6.2.2.8 Compare the damage count values obtained as in **6.2.2.6** and **6.2.2.7.**

NOTE — The control specimen shall always show a lower damage count value than the test specimen. If the difference of the damage count of the control and test specimens is more than 10, the fabric should be declared as damaged.

7. REPORT

7.1 The report shall include the following information:

a) Nature and position of the damaged portion of the fabric as examined visually;

b) Whether fungi are present;

c) Whether bacteria are present;

d) Loss in breaking load percent, of the basic fabric after being damaged;

e) Damage count of the test specimen; and

f) Damage count of the control specimen.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 $kg.m/s^2$
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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